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NORTHERN

Utilization Research & Development Division

Publications and Patents

January - June 1970

**Agricultural Research Service
United States Department of Agriculture**

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Northern Utilization Research and Development Division
Agricultural Research Service
United States Department of Agriculture
1815 North University
Peoria, Ill. 61604

INTRODUCTION

The Congress in 1938 authorized four regional laboratories, now known as Utilization Research and Development Divisions, to conduct basic and applied research designed to expand, improve, and develop through science and technology the utilization of American farm crops. The need and importance of such research arise because the farmer is not organized to carry on modern scientific research to maintain old markets for his products and to create new ones. Since their inauguration, these laboratories have contributed much basic knowledge of the chemical composition and physical properties of farm commodities and have applied this knowledge to create new or improved products and processing technology that have enhanced utilization of many farm commodities.

In 1969, the Southeastern Agricultural Research Laboratory, headquarters of the Southeastern Utilization Research and Development Division, was built to serve the specialized needs of that region.

The Northern Utilization Research and Development Division is responsible for research on industrial utilization of the cereal grains--corn, wheat, barley, grain sorghum,

and oats; and oilseeds--soybeans and flaxseed. Except for wheat and barley, the research includes food and feed uses of these crops. In the Department's program of research on replacement crops, the Northern Division conducts all screening and characterization studies on uncultivated plants and their components. It is also responsible for more intensive research on new oilseeds containing erucic acid and on new gum and pulp fiber plants. In addition to its internal program of research, it carries out work through domestic contracts and grants and conducts related research abroad under grants or contracts involving Public Law 480 funds.

The research investigations at the Northern Division are supported by more than 450 people, about one-half of whom have professional status. This body of highly trained men and women with specialized knowledge in various disciplines are responsible for the scientific publications and patents listed here.

General information about these four Divisions is given inside the back cover.

REQUEST FOR INFORMATION

The results of the research of the Northern Utilization Research and Development Division are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 60). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. The abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the Department of Agriculture, Northern Division publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

Requests for specific reprints should be by number and addressed to the Northern Division. Those titles marked with an asterisk [*] are not available for distribution.

Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Division can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Washington, D.C. 20250.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.

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PUBLICATIONS

[Publications marked with an asterisk (*) are not available for distribution. When requesting reprints, please order by number.]

- 2619 • First Bond Paper Made Using Kenaf Pulp in the Furnish
T. F. Clark
Paper Trade J. 154(2): 48-49. January 12, 1970

A papermaking demonstration was made before the Nonwood Plant Fibers Committee of the Technical Association of Pulp and Paper Industry. Kenaf pulp produced by continuous cooking constituted 40% of the machine furnish. This research run was made on the 32-inch fourdrinier machine installed at the Northern Division. Use of kenaf provides opportunities to alleviate developing shortages in supplies of pulpwoods, as well as other benefits.

- 2620 • Phenolic and Sugar Components of Armavirec Variety
Sunflower (*Helianthus annuus*) Seed Meal
K. L. Mikolajczak, C. R. Smith, Jr., and I. A. Wolff
J. Agr. Food Chem. 18(1): 27-32. January-February 1970

Caffeic (3,4-dihydroxycinnamic) acid, chlorogenic (3-caffeoylquinic) acid, and 3,5-dicaffeoylquinic acid have been identified in the aqueous methanol extract of defatted seed meal of sunflowers (Armavirec variety). Another disubstituted cinnamic acid has been isolated in the free state and also as a monoester of quinic acid. This aromatic acid appears to have a hydroxyl and a methoxyl substituent at either the 2,4- or 2,5-positions. Several other minor phenolic constituents have been detected but not identified. The aqueous methanol extract also yielded three disaccharides and a trisaccharide (1.9%) identified as raffinose. The disaccharide isolated in the largest amount (4.4% of the defatted meal) was sucrose. Another, which yielded only glucose on complete acid hydrolysis, is probably α,α' -D-trehalose. The third disaccharide was cleaved to glucose and fructose by the same treatment. Total phenolic content of the defatted meal was about 2.4%, and the total amount of sugars isolated, 9.7%.

- 2621 • Proximate Composition and Proteins of Three Grain Sorghum Hybrids and Their Dry-Mill Fractions
R. W. Jones and A. C. Beckwith
J. Agr. Food Chem. 18(1): 33-36. January-February 1970

In a study of the essential constituents of three grain sorghums, special emphasis was placed on their protein fractions. Sorghum was milled in a Buhler mill to obtain bran, shorts, and flour fractions. Each fraction was extracted successively with water, 1% sodium chloride, and 60% alcohol (*t*-butyl alcohol at room temperature or ethanol at 60° C.). The three sorghums had similar chemical compositions and milling properties. Also similar were solubility, electrophoretic patterns, and amino acid content of the protein.

- 2622 • Protein Composition of Proso Millet
R. W. Jones, A. C. Beckwith, U. Khoo, and G. E. Inglett
J. Agr. Food Chem. 18(1): 37-39. January-February 1970

Dehulled white proso millet was ground to a flour preparatory to studying its protein composition. The flour was extracted successively with water, 1% sodium chloride, and alcohol. Both 60% *t*-butyl alcohol and 60% ethanol were used. Electrophoretic patterns and amino acid composition of each extract were obtained. Protein bodies were identified by both light and electron microscopy. They are composed mainly of prolamines, which dissolve in hot *t*-butyl alcohol.

- 2623 • Inactivation of Peroxidase as a Function of Corn Processing
H. W. Gardner, G. E. Inglett, and R. A. Anderson
Cereal Chem. 46(6): 626-634. November 1969

Measurement of peroxidase activity is used as a method to quantitate enzyme destruction in processed corn. Dry-mill processing usually results in a small amount of enzyme destruction. Peroxidase activities in the dry-milled fractions vary, largely because of the anatomical origin of the fraction. The germ fraction is much more active than the fractions derived from endosperm or pericarp. Roll- and extrusion-cooking of grits often result in total inactivation of peroxidase activity. The degree of inactivation depends upon the amount of heat and moisture used in the process, and it can be correlated with either water-absorption properties of the product or consistency of a mixture of the product with water.

2624 • Purification and Properties of Soybean Allantoinase

L. C. Wang and R. L. Anderson

Cereal Chem. 46(6): 656-663. November 1969

Soybean allantoinase was purified by ammonium sulfate precipitation, diethylaminoethyl cellulose chromatography, and gel filtration. The enzyme, which is present in soybean whey, was purified 671-fold from a pH 4.5 acetate buffer extract. The yield was more than 30%. Allantoinase has a sedimentation coefficient of 4.9S, which corresponds to a molecular weight of about 50,000. The enzyme has an optimum pH of 8.4 K_m of 4.4×10^{-2} M, and an optimum temperature at 70° C. Short heating of the buffer extract activates the enzyme; it is six times more active at 70° C. than at 25° C., but it inactivates twice as fast at temperatures higher than 70° C., its optimum activation point.

2625 • Lipid Oxidation in Full-Fat and Defatted Soybean Flakes as Related to Soybean Flavor

D. J. Sessa, D. H. Honig, and J. J. Rackis

Cereal Chem. 46(6): 675-686. November 1969

Extracting 99.8% of the oil from full-fat soybean flakes with pentane-hexane removed none of their green-beany, bitter flavor. This oil, with paraffinlike, vegetable-oil flavor, did not develop any further flavor on storage. Almost all the flavor and residual lipids from defatted soybean flakes were extracted by hexane-absolute ethanol azeotrope (79:21). The oil and azeotrope extracts had thiobarbituric acid (TBA) numbers of 5.8 and 34, respectively, which were computed from absorbance readings of 532 mμ. The oil and azeotrope extracts contributed about 10% to the TBA number of full-fat flakes. In both full-fat and defatted flakes, *n*-hexanal, acetaldehyde, and acetone represented the major volatile carbonyl compounds. These were characterized as 2,4-dinitrophenylhydrazones. No malonaldehyde derivative was obtained from the flakes. From defatted flakes, 3.6 p.p.m. carbonyl compounds were vacuum-stripped, but removal of this amount did not affect the original soybean flavor. Consequently, flavor of flakes could not be correlated with degree of oxidation as measured by TBA and volatile carbonyl compound analyses. Trace amounts of hydroperoxides appeared in lipid extracts from defatted flakes. When a soybean lipid extract, possessing similar composition to commercial soybean phosphatides, was UV-irradiated, the TBA number decreased from 67 to 33 and the flavor changed from that of paraffin and vegetable oil to that associated with rubber. Similar irradiation of commercial phosphatides generated TBA-reactive substances and bitter rancid flavors not characteristic of soybeans.

2626* • 発酵食品

[Fermented Foods]

C. W. Hesseltine [Translated into Japanese by Eiji Koyama]
Shokuhin to Kagaku [Food and Science] 12(4): 1-6. 1969

As an important part of diets around the world, fermented foods offer some advantages over other food products. Some examples are: sufu, tempeh, magou, and Bantu beer. The first is a Chinese mold fermentation of tofu that gives a cheeselike product. Tempeh is a mold fermentation of dehulled soybeans carried out in the East Indies. Magou is fermented from white corn meal in South Africa. Bantu beer is made from sorghum and maize in South Africa, with a current production of 150 million imperial gallons per year. The two South African fermentations are examples of how primitive native fermentations may become highly industrialized. Research on sufu and tempeh at the Northern Division is described.

2627 • Homogeneous Hydrogenation of Diolefins Catalyzed by Tricarbonyl Chromium Complexes. I. Stereoselective 1,4 Addition of Hydrogen

E. N. Frankel and R. O. Butterfield

J. Org. Chem. 34(12): 3930-3936. December 1969

Arene-Cr(CO)₃ complexes catalyze selectively the homogeneous hydrogenation of conjugated dienes by 1,4 addition to give predominantly *cis* monoenes. With 1,4-dienes, conjugation to the 1,3-dienes precedes addition. With *cis*-1,3-dienes, isomerization by a 1,5-hydrogen shift during hydrogenation is indicated. Reduction rates are decreased by methyl substituents on C-1 and C-4 of the 1,3-diene system. Although 1,5-hexadiene is not reduced or isomerized, 1,5-cyclooctadiene is readily isomerized to 1,4- and 1,3-dienes and reduced to cyclooctene. Kinetic studies with computer simulation techniques show that, in a mixture, 1,3-cyclohexadiene is reduced twice as fast as 1,4-cyclohexadiene with methyl benzoate-Cr(CO)₃. A mixture of conjugated methyl linoleate (9,11- and 10,12-octadecadiene) is reduced 22 times faster than methyl linoleate (9,12-diene). The arene-Cr(CO)₃ catalysts are highly stereoselective for *trans,trans*-conjugated dienes (relative rates: *cis,cis*, 1.0; *cis,trans*, 8.0; and *trans,trans*, 25). The mechanism advanced for conjugate addition involves H₂Cr(CO)₃ and its 1,3-diene adduct, which undergoes 1,4-hydrogen insertion across a cisoid 1,3-diene system.

- 2628 • Homogeneous Hydrogenation of Diolefins Catalyzed by Tricarbonyl Chromium Complexes. II. Deuteration
E. N. Frankel, E. Selke, and C. A. Glass
J. Org. Chem. 34(12): 3936-3942. December 1969

Deuterium tracer studies provide direct evidence that 1,4 addition is the dominant mechanism of reduction catalyzed by arene-Cr(CO)₃. Catalytic deuteration of dienes yields almost exclusively monoenes-d₂ with deuterium located on the α-methylenes. Hydrogen and deuterium addition are predominantly molecular. Although no deuterium is exchanged with hydrogen in conjugated dienes, this exchange occurs at the α-methylenes in methyl linoleate and oleate and is apparently stereoselectively *cis*. With monoenes, positional and geometric isomerization by a 1,3-hydrogen shift is indicated. Key intermediates postulated include D₂Cr(CO)₃ and diene-D₂Cr(CO)₃ for 1,4 addition, *cis* monoolefin-Cr(CO)₃ for deuterium exchange, and π-allyl-CrH(CO)₃ for isomerization reactions.

- 2629 • Migration of Thiolthiocarbonyl Groups in Selectively Protected Methyl α-D-Glucopyranoside Xanthates
D. Trimnell, W. M. Doane, C. R. Russell, and C. E. Rist
Carbohydr. Res. 11(4): 497-507. December 1969

A series of benzylxanthate esters of methyl α-D-glucopyranoside selectively methylated at various hydroxyl groups was synthesized. The esters were converted into the corresponding xanthate salts, and their behavior was investigated under alkaline conditions typical of xanthation media. Results reveal that migration of thiolthiocarbonyl groups from the 2- or 3-position to the 6-position proceeds via the hydroxyl group at C-4. Direct migration across the pyranose ring from the 2- or 3-position to the 6-position was negligible. The (benzylthio)-thiocarbonyl position for each ester was identified by nuclear magnetic resonance spectroscopy. Primary substitution caused the signals for the two protons at C-6 to be displaced downfield by about 1.0 p.p.m., and secondary substitution caused a 2.4-p.p.m. downfield shift of the signals for protons at C-2, C-3, and C-4.

- 2630 • Visualization Reagents for Quantitation of Carbohydrates on Thin-Layer Chromatograms by Transmission Densitometry
J. Lehrfeld and J. C. Goodwin
J. Chromatogr. 45(1): 150-154. November 1969

Four sulfuric acid-type visualization reagents were evaluated for the quantitation of glucose, methyl α -D-glucopyranoside, and maltose on thin-layer chromatograms. A linear relationship was found between the amount of carbohydrate in the spot and intensity of the spot for each of the reagents. However, the degree of precision and ease of handling were markedly different for the various reagents in the group. Considering these factors, their suitability for use as quantitation reagents is in the following order: sulfuryl chloride > 3.3% sulfuric acid > 50% sulfuric acid >> ammonium sulfate.

- 2631 • Gas Chromatographic Equivalent Chain Lengths of Isomeric Methyl Octadecenoates and Octadecynoates
C. R. Scholfield and H. J. Dutton
J. Amer. Oil Chem. Soc. 47(1): 1-2. January 1970

Equivalent chain lengths (ECL) have been determined for methyl *cis*-5-, 6-, 8-, 9-, 10-, 11-, 12-, 15-; *trans*-2-, 3-, 5-, 6-, 8-, 9-, 10-, 11-, 12-, 15-; and 17-octadecenoates and for methyl 5-, 6-, 8-, 9-, 10-, 11-, 12-, and 15-octadecynoates on diethylene glycol succinate, polyphenol ether, and 100% β -cyanoethylmethylsiloxane capillary columns. Although the levels of ECL values differed, the patterns were similar for the different substrates. For methyl octadecenoates, except for 2-isomers, ECL generally increased with distance of double bond from the ester group but changed little from the 6 to the 10 position. Differences were smaller among isomeric *trans* esters than among *cis*. In methyl octadecynoates a greater and more regular increase of ECL occurred as the triple bond moved away from the ester group.

- 2632 • Conversion of Polyunsaturates in Vegetable Oils to *cis*-Monounsaturates by Homogeneous Hydrogenation Catalyzed with Chromium Carbonyls
E. N. Frankel
J. Amer. Oil Chem. Soc. 47(1): 11-14. January 1970

Chromium carbonyl complex catalysts were used to selectively hydrogenate polyunsaturates in vegetable oils into products retaining 90% to 95% *cis* configuration and their liquid properties. The product from soybean oil contained 42-69% monoene, 10-40% diene, and 0-4% triene. The product from safflower oil contained 73-82% monoene and 8-17% diene. About 45-55% of the double bonds in monoenes from hydrogenated soybean oil remained in the C₉ position, and the rest was distributed between C₁₀, C₁₁, and C₁₂. Preliminary oxidative and flavor stability evaluations showed that these hydrogenated soybean oils compared favorably with a commercial sample of hydrogenated-winterized soybean oil. Liquid fatty acids prepared by saponification of hydrogenated soybean and safflower oils (IV 90-100) had analyses about the same as those of commercial oleic acid.

- 2633 • Stability of Crude Sunflower Oils to Autoxidation and to Seed Aging
K. L. Mikolajczak, C. R. Smith, Jr., and I. A. Wolff
J. Amer. Oil Chem. Soc. 47(1): 24-25. January 1970

Crude seed oils of Russian sunflower varieties, Armavirec and VNIIMK 8931, are somewhat more stable to gross autoxidation than crude oils of two commercial U.S. varieties, Arrowhead and Mingren. Small amounts of oxygenated fatty acids found previously in sunflower seed oils have been shown to be produced during seed storage.

- 2634 • Survey of Tall-Fescue Pasture: Correlation of Toxicity of *Fusarium* Isolates to Known Toxins
S. G. Yates, H. L. Tookey, and J. J. Ellis
Appl. Microbiol. 19(1): 103-105. January 1970

Several aspects of fescue foot in cattle suggest that this disease is caused by fungi growing on fescue grass. Certain fungi isolated from winter pasture yield toxins when grown on synthetic medium. Most of these toxin producers belong to the genus *Fusarium*. All but 1 of the 21 toxic and 7 questionably toxic *Fusarium* isolates produce either 4-acetamido-4-hydroxy-2-butenic acid γ -lactone, or 4 β ,15-diacetoxy-8 α -(3-methylbutyryloxy)-12,13-epoxytrichothec-9-en-3 α -ol, or both.

2635 • Stability of Vitamin A in Wheat Flour

R. A. Anderson and V. F. Pfeifer

Northwest. Miller 277(3): 14, 16-18. March 1970

Wheat flour at 13.8% moisture content was fortified with vitamin A concentrates from three manufacturers and stored at 26°, 37°, and 45° C. for up to 6 months. Vitamin A from all concentrates showed good stability at 26° C. At 37° and 45° C. fair to poor stability was encountered. Data for the three temperatures could be correlated on Arrhenius-type plots, so that predictions of potency retention can be made at various storage conditions within or near the ranges studied.

2636 • Infectivity of Spores of *Bacillus popilliae* Produced on a Laboratory MediumPaul H. Schwartz, Jr.¹ and Eugene Sharpe(¹USDA Entomology Res. Div., Moorestown, N.J.)

J. Invertebr. Pathol. 15(1): 126-128. January 1970

No occurrence of milky disease resulted when third-instar larvae of the Japanese beetle, *Popillia japonica*, were exposed to soil containing 2 billion spores per kilogram of strain NRRL B-2309M of the milky disease bacterium, *Bacillus popilliae*, produced on a laboratory medium, or when the larvae imbibed 200,000 of the spores of strain NRRL B-2309M in aqueous suspension; however, 24% of the larvae were infected when they were injected with 10,000 of the spores. In contrast, spores produced commercially in diseased larvae infected 60% of the larvae exposed to soil containing 2 billion spores per kilogram, 60% of the larvae that imbibed 280,000 spores in an aqueous suspension, and 40% of the larvae injected with 10,000 spores.

2637 • 1,3:4,6-Di-O-benzylidene-D-mannitol

H. B. Sinclair

Carbohydr. Res. 12(1): 150-152. January 1970

A simple procedure is reported for preparing 2,5-di-O-methyl-D-mannitol (or its peracetate). Condensation of D-mannitol with benzaldehyde in acidified methyl sulfoxide gave (previously unreported) 1,3:4,6-di-O-benzylidene-D-mannitol, which on subsequent methylation and hydrolysis (one step) gave the dimethyl mannitol.

2638 • Dry-Milling Artificially Dried Corn; Roller-Milling of Degerminator Stock at Various Moistures

O. L. Brekke

Cereal Sci. Today 15(2): 37-42. February 1970

Experimental results demonstrate that milling moisture level influences both yield and fat content of the milled products. Moisture level should be closely controlled to obtain results best meeting the miller's needs.

2639 • Homogeneous Catalytic Conjugation of Polyunsaturated Fats by Chromium Carbonyls

E. N. Frankel

J. Amer. Oil Chem. Soc. 47(2): 33-36. February 1970

Various arene-Cr(CO)₃ complexes and Cr(CO)₆ are effective soluble catalysts for the conjugation of polyunsaturated fats. Methyl benzoate-Cr(CO)₃ is one of the most active catalysts. The following conjugation levels were obtained: methyl linoleate, 65%; methyl linolenate, 45%; the polyunsaturates in soybean and safflower oils, 73%; and in linseed oil, 48%. Conjugated dienes from linoleate were predominantly *cis,trans* in configuration. Their double bonds were distributed between C₅ and C₁₆ of the fatty acid chain. Hydrogenation and dehydrogenation are side reactions, which seem to limit the yield of conjugated dienes from methyl linoleate. A conjugation mechanism is proposed that involves allyl-HCr(CO)₃ complexes as intermediates undergoing 1,3- and 1,5-hydrogen shifts.

2640 • Ethylene Adduct of Conjugated Octadecadienoic Acids: I. Peracid Oxidation Products

E. J. Dufek, L. E. Gast, and J. P. Friedrich

J. Amer. Oil Chem. Soc. 47(2): 47-50. February 1970

8-(4-*n*-Hexylcyclohex-2-enyl)octanoic acid obtained by the addition of ethylene to *trans,trans*-9,11-octadecadienoic acid was treated with 28% hydrogen peroxide in acetic or formic acid to give the hydroxyacetoxo or -formoxy derivative. Saponification of the hydroxyacetoxo derivative yielded two crystalline glycols. The hydroxyformoxy fatty acid was converted in one step either to the glycol ester, methyl 8-(4-*n*-hexyl-2,3-dihydroxycyclohexyl)octanoate, by reaction with anhydrous hydrochloric acid in methanol or to the acetone derivative of the glycol ester by treatment with dimethoxypropane and anhydrous hydrochloric acid in methanol. Epoxidation of the C₂₀ cyclohexene fatty methyl ester gave the oxirane derivative. A ring opening reaction of the diol acid with periodic acid yielded 9,12-diformylstearic acid.

- 2641 • Ethylene Adduct of Conjugated Octadecadienoic Acids:
 II. Ozonization Products
 E. J. Dufek, J. C. Cowan, and J. P. Friedrich
 J. Amer. Oil Chem. Soc. 47(2): 51-55. February 1970

Methyl 8-(4-*n*-hexylcyclohex-2-enyl)octanoate obtained by esterifying the adduct of ethylene and *trans,trans*-9,11-octadecadienoic acid was ozonized in methanol as a participating solvent. The resultant cyclic methoxyhemiperacetal was reduced with powdered zinc to the dialdehyde, methyl 9,12-diformylstearate, which was isolated as the tetramethyl-diacetal. This dialdehyde readily air-oxidizes to give methyl 9,12-dicarboxystearate. Heating the cyclic methoxyhemiperacetal slowly from 25° to 100° C. in vacuo results in an unusual decomposition reaction which gives hydrogen and methyl 9(12)-carbomethoxy-12(9)-carboxystearate as the primary products and methyl 9(12)-carbomethoxystearate as the major byproduct. Treatment of the cyclic hemiperacetal with hydrogen peroxide in formic acid gave unexpectedly dihydroxystearic acid as one of the products.

- 2642 • Modification of Wheat Starch by Initiating Systems
 Used for Graft Polymerization
 George F. Fanta, Robert C. Burr, C. R. Russell, and
 C. E. Rist
 Cereal Chem. 47(1): 85-91. January 1970

Treatment of wheat starch with ceric ammonium nitrate in dilute nitric acid or with ferrous ammonium sulfate-hydrogen peroxide, under conditions used for graft polymerization but in the absence of monomer, gave products only partially dispersible in 90:10 (by volume) dimethyl sulfoxide-water. With ceric ion-nitric acid, the amount and intrinsic viscosity of the dispersible fraction depended on both the degree of swelling of the starch (before treatment with ceric ammonium nitrate solution) and on whether the acidic reaction mixture was neutralized before isolation of the product. Dilute nitric acid in the absence of ceric ammonium nitrate gave a completely dispersible product whose intrinsic viscosity slowly decreased with reaction time. Electron beam irradiation of wheat starch also gave a completely dispersible and apparently degraded product. In contrast to their behavior in dimethyl sulfoxide-water, starches treated with ceric ion-nitric acid or the ferrous ion-hydrogen peroxide system were more readily dispersed in water than untreated wheat starch.

2643 • Soybeans

J. C. Cowan

In "Kirk-Othmer Encyclopedia of Chemical Technology,"
2nd ed., vol. 18, pp. 599-614. 1969

A condensed review of chemical and other important aspects of soybeans and soybean products is presented.

2644* • Chemistry of Soybean Proteins

W. J. Wolf, J. J. Rackis, and A. K. Smith

In "Chemical and Physical Aspects of Food," ed.

James Muil Leitch, Vol. I, Proc. First Int. Congr.

Food Sci. Technol., London, 1962, pp. 131-141. 1969

Three fractions are obtained in the isolation of soybean protein: acid-precipitated protein, insoluble meal residue, and whey. Isolated protein is an article of commerce, the residue is added to animal feeds, and whey presents a waste disposal problem. Amino acid analysis of isolated protein indicates a good balance of essential amino acids. Impurities present in isolated protein include phytate, phospholipids, and nucleic acid. Ultracentrifugal analysis of isolated protein indicates four fractions. The major fractions are high-molecular-weight globulins possessing a sub-unit structure. The major globulins undergo several reactions, such as association to higher molecular weights, dissociation into sub-unit, and formation of disulphide-linked polymers. These reactions affect solubility of the proteins and turbidity and viscosity of their solutions. DEAE-cellulose chromatography and electrophoresis of soybean whey proteins reveal a complex mixture containing two trypsin inhibitors, hemagglutinin, lipoxigenase, phosphatase, amylase, and other unidentified components.

Soybean proteins are often used in foods for their functional properties, which include dough-forming, water-binding, fat-binding, foaming, gelation, film-forming, thickening, emulsifying, cohesion, and adhesion. These functional properties are discussed in the light of known reactions and properties of the proteins.

2645* • *Cephalotaxus*--Source of Harringtonine, A Promising New Anti-Cancer Alkaloid

Robert E. Perdue, Jr.,¹ Lloyd A. Spetzman,¹ and
Richard G. Powell

(¹USDA Crops Research Div., Beltsville, Md.)

Amer. Hort. Mag. 49(1): 19-22. Winter 1970

The plumyews (*Cephalotaxus*) are yewlike evergreen trees and shrubs, which include seven species native to southeastern Asia. Two species are in cultivation in the United States--*C. harringtonia*, of which there are several varieties, and *C. fortunei*.

Extracts of *Cephalotaxus* have demonstrated significant activity against leukemia in laboratory mice. One of the principal active constituents is a new alkaloid, harringtonine, recently isolated and characterized at the Northern Division.

Now that harringtonine has been cleared by the National Cancer Institute for preclinical pharmacological evaluation, it will be tested in dogs and other animals to determine possible adverse side effects and appropriate doses for administration to human patients. An appreciable quantity of harringtonine will be required for these studies and for the clinical trials that, hopefully, will follow. Because harringtonine may not be readily adaptable to chemical synthesis, the plant may be the only practical source of this alkaloid. Known supplies of plant material, however, are not sufficient for present and projected future needs.

A detailed botanical description is given in this paper along with several illustrative photographs. Information, from nurserymen and other readers, is requested on sources of nursery stock or of older *Cephalotaxus* plants, especially those that produce good crops of fruits. We are interested in any species or horticultural varieties that may be available.

2646 • Sugars with Reactive Substituents: Preparation of 3-*O*-(2,3-Epoxypropyl and 2,3-Epithiopropyl)-1,2:5,6-di-*O*-Isopropylidene- α -D-Glucofuranose

R. E. Wing, W. M. Doane, and C. E. Rist

Carbohydr. Res. 12(2): 285-289. February 1970

The 3-*O*-(2,3-epoxypropyl and 2,3-epithiopropyl)-ethers of 1,2:5,6-di-*O*-isopropylidene- α -D-glucofuranose have been prepared. These compounds were synthesized by several different methods in almost quantitative yields.

- 2647 • Unusual Olefinic Fatty Acids in Seed Oils from
Two Genera in the Ranunculaceae
G. F. Spencer, R. Kleiman, F. R. Earle, and I. A. Wolff
Lipids 5(2): 277-278. February 1970

Oil from one of the two species of *Anemone* investigated contained 20% of γ -linolenic acid but the other had none. Linoleic acid was the major component in both oils. Four of the five species of *Ranunculus* produced oil containing 2% to 4% of a component identified in one sample as *cis*-7,*cis*-10-hexadecadienoic acid. Major components were linoleic and linolenic acids.

- 2648 • Comparative Studies on Glutenins from Different
Classes of Wheat
Floyd R. Huebner
J. Agr. Food Chem. 18(2): 256-259. March-April 1970

Glutenins from 11 varieties of wheat representing the five different classes commonly grown in the United States were compared in terms of protein composition and sensitivity to salt precipitation. Gluten obtained from the different wheats varied from 8 to 10.5% for soft wheats to about 9 to 11% for hard wheats and 17% for durum. Gliadin-glutenin ratios were similar in all varieties investigated: generally 46 to 50% gliadin to 50 to 54% glutenin. Electrophoretic patterns of the reduced and alkylated glutenins showed significant variations among varieties of the same class, but the greatest differences were among classes. Reduced-alkylated glutenin from durum wheats contained little or none of the slowest moving components present in the other wheats analyzed. Response of glutenins to precipitation with salt suggests that the quality of a gluten may be related to the sensitivity of its glutenin proteins to changes in ionic strength. Varieties recognized for higher quality in making bread or pasta products yield steeper precipitation curves than poorer quality wheats. The relationship is most valid for wheat varieties in the same class.

- 2649 • Micro Vapor-Phase Hydrogenation Monitored with Tandem Chromatography-Radioactivity: III. Isomeric Monoenes
T. L. Mounts, R. O. Butterfield, C. R. Scholfield,
and H. J. Dutton
J. Amer. Oil Chem. Soc. 47(3): 79-82. March 1970

Micro vapor-phase hydrogenation and radiotracer techniques have been utilized to investigate the effect of geometric configuration and double bond position on the rate of hydrogenation of octadecenoates. These techniques provide for simultaneously monitoring the time course of vapor-phase hydrogenation both for an essentially pure monoene isomer by thermal conductivity and for methyl oleate by radioactivity. The two hydrogenations proceed independently but have identical parameters of temperature, flow rate, and catalyst activity. The experimental data are plotted, relative reaction rates are calculated, and theoretical curves are drawn by a digital computer system with plotter accessory. Experiments with nickel catalysts indicate that rates of reduction are affected by both the position and configuration of the double bond. *cis*-15-Octadecenoate is reduced 1.4 times faster than its *cis*-9 isomer. Both *cis*-9- and -12-octadecenoate are reduced at approximately equal rates. *cis*-9-Octadecenoate was reduced 1.4 times as fast as the *cis*-6 isomer. Oleate was reduced 1.27 times as fast as elaidate.

- 2650 • Thin Layer and Anion Exchange Chromatography of Soybean Saponins
W. J. Wolf and Betty W. Thomas
J. Amer. Oil Chem. Soc. 47(3): 86-90. March 1970

Twenty-two solvent systems were evaluated for thin-layer chromatography (TLC) of soybean saponins on silica gel. A maximum of four fractions separated by single development with the different solvents. Six successive developments with chloroform-methanol-water (65:25:4) separated soybean saponins into 10 or more fractions. Column chromatography of soybean saponins on an anion-exchange resin with a linear gradient of acetic acid yielded seven fractions. Multiple development TLC of the saponins separated by column chromatography showed that a definite fractionation occurred. Several column chromatographic fractions contained components with identical TLC R_f values, but the components were clearly different on the basis of colors detected with sulfuric acid and on the basis of their elution positions from the ion-exchange resin. Soybean saponins are more complex mixtures than previously recognized but can be fractionated by chromatography on thin-layer plates and anion-exchange resins.

- 2651 • Computer-Guided Explorations in Lipid Chemistry
Herbert J. Dutton
J. Amer. Oil Chem. Soc. 47(3): 98A, 100A, 102A,
120A, 122A. March 1970

Address before the First Plenary Session of the American Oil Chemists' Society, October 6, 1969, Minneapolis, Minnesota, after accepting the 1969 Award in Lipid Chemistry.

The concept of computer-guided experimentation is illustrated in lipid research with recent examples of (1) simulations of chemical and physical phenomena, (2) processing of laboratory data, and (3) data acquisition in on-line or real time mode.

- 2652 • Selective Hydrogenation of Soybean Oil: V. A Novel Copper Catalyst with Excellent Re-use Properties
Sambasivarao Koritala
J. Amer. Oil Chem. Soc. 47(3): 106-107. March 1970

A procedure for the preparation of highly active copper catalyst by chemisorption of copper-ammonia complex on silica gel is described. This catalyst was highly selective towards the reduction of linolenate in soybean oil. The catalyst was re-used four times with no loss in activity.

- 2653 • Scanning Electron Microscopy of Soybean Protein Bodies
W. J. Wolf
J. Amer. Oil Chem. Soc. 47(3): 107-108. March 1970

Protein bodies prepared from defatted soybean flour contained numerous spherical particles 1-3 μ in diameter, plus amorphous material, when examined in a scanning electron microscope. Full-fat and defatted soybean flours contained particles 1-10 μ in diameter. The larger protein bodies apparently disrupted during isolation. The scanning technique is a simple and rapid method for observing the effects of various treatments on subcellular seed particles of this size.

- 2654 • New Crops. A List of Publications for 1969
North. Util. Res. Develop. Div.
U.S. Agr. Res. Serv., ARS-71-19-8, 6 pp. March 1970
[Processed]

- 2655 • Poly(ester-acetals) from Azelaaldehydic Acid-Glycerol Compounds
 W. R. Miller, R. A. Awl, E. H. Pryde, and J. C. Cowan
 J. Polym. Sci., Part A-1, 8(2): 415-427. February 1970

Poly(ester-acetals) have been prepared from isopropylideneglyceryl azelaaldehydate dimethyl acetal and from methyl azelaaldehydate glycerol acetal. Acid hydrolysis of isopropylideneglyceryl azelaaldehydate led to oligomeric poly(ester-acetals) with six to seven repeating units and carboxylic acid end groups from which the sodium salt and the methyl ester could be prepared. The polymer sodium salt showed some surfactant properties. Methyl azelaaldehydate glycerol acetal, a mixture of geometric and structural isomers, was polymerized under typical polyesterification conditions. Lime was the best catalyst found. Molecular weights of 5,000 to 12,000 were obtained. Some of these polymers contained significant quantities of calcium as the carboxylate salt. A tough elastomer was prepared by heating a poly(ester-acetal) with *p*-toluenesulfonic acid and zinc oxide.

- 2656 • Poly(ester-acetals) from Geometric Isomers of Methyl Azelaaldehydate Glycerol Acetal
 Robert W. Lenz,¹ R. A. Awl, W. R. Miller, and E. H. Pryde
 (¹University of Massachusetts, Amherst)
 J. Polym. Sci., Part A-1, 8(2): 429-444. February 1970

The glycerol acetal of methyl azelaaldehydate is an ω -hydroxy ester that exists as a mixture of dioxolanyl and dioxanyl isomers, each having two geometric isomers. Each of the four isomers was isolated by chromatographic (gas-liquid and column) and fractionating (crystallization and distillation) methods. Structural assignments were made on the basis of nuclear magnetic resonance and infrared spectral data. Linear poly(ester-acetals) were prepared from each of the *cis* and *trans* forms of the dioxanyl isomers and from a mixture of the dioxolanyl geometric isomers. Physical properties of these polymers were correlated with their structures. When prepared with basic condensation catalysts, the polymers retained the geometric configuration and structural identity of the monomer. When prepared with lead acetate, structural rearrangement as well as polycondensation occurred, resulting in an enrichment of the dioxolanyl isomer and simultaneous increase in polymer crystallinity. The enrichment took place at elevated temperatures and also, unexpectedly, at room temperature upon long standing of the polymer. Isomer redistribution at room temperature appears to be antithermodynamic in the reaction sense, yielding a polymer of unusually high dioxolanyl unit content. The driving force for this isomerization may be crystallization of these units by a phenomenon termed a "crystallization-induced reaction."

- 2657 • Conditions for Production of Ochratoxin 'A by *Aspergillus* Species in a Synthetic Medium
Mingtian Lai,¹ G. Semeniuk,¹ and C. W. Hesseltine
(¹South Dakota State University, Brookings)
Appl. Microbiol. 19(3): 542-544. March 1970

Trace elements were required by *Aspergillus melleus* and *A. ochraceus*, but not by *A. sulphureus*, to grow and to elaborate ochratoxin A. The composition of the medium affected the synthesis of the toxin more than the growth of the mycelium.

- 2658 • Swelling of Linseed Oil Films in Acid and Alkaline Environments
R. L. Eissler and L. H. Princen
J. Paint Technol. 42(542): 155-158. March 1970

Swelling of films of a bodied linseed oil (OKO M37 viscosity) was determined in a series of buffer solutions and water slurries formed from zinc oxide, anatase titanium dioxide, or rutile titanium dioxide pigments. Films did not swell in acid solutions. In alkaline solutions swelling increased with pH. In solutions of either zinc chloride or sodium chloride in distilled water, swelling of unpigmented films was about the same as that in water alone. Inclusion of additional sodium ion in buffer solutions caused no increase in film swelling beyond that attributed to pH. Infrared spectra of films that had been immersed in acid solutions or distilled water for several weeks were similar to those of untreated controls. Spectra of films immersed in alkaline slurries or buffers developed an absorption peak at 6.3 to 6.4 μ . Similarity among spectra indicates strongly that in our experiments the swelling mechanism was the same in both buffers and slurries. Pigmented films swell, apparently, because the weakly acid character of linseed oil is insufficient to overcome excess alkalinity contributed by certain pigments to a film in the presence of water.

- 2659 • Sexual Reproduction in *Candida lipolytica*
Lynferd J. Wickerham, Cletus P. Kurtzman, and Alberta I. Herman
Science 167(3921): 1141. February 1970

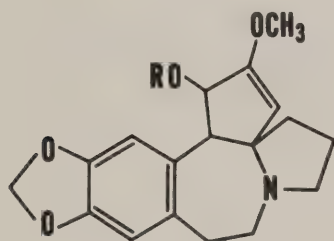
Candida lipolytica is a rather common yeast isolated more frequently from substrates containing lipids or proteins, such as dairy products, than from substrates rich in sugars. This species assimilates hydrocarbons and currently is being studied for its potential to convert petroleum into yeast cells for use in feeds and foods. We have found *C. lipolytica* to exist in nature primarily in the heterothallic haploid state. When appropriate strains of opposite sex are mixed on a suitable sporulation medium, conjugation occurs followed by the production of ascospores. Since heterothallism permits laboratory control of hybridization, this characteristic of *C. lipolytica* enhances the possibility of improving its strains for technological uses.

2660 Structures of Harringtonine, Isoharringtonine, and Homoharringtonine

R. G. Powell, D. Weisleder, C. R. Smith, Jr., and
W. K. Rohwedder

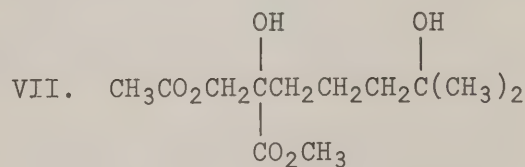
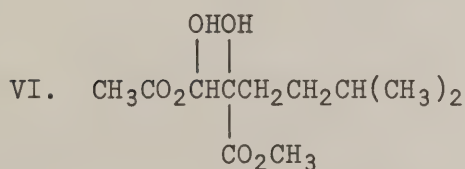
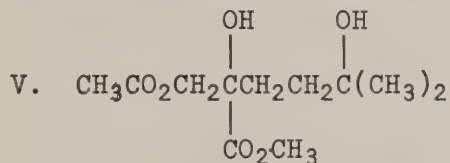
Tetrahedron Lett. (11): 815-818. March 1970

Partial structures are reported for three alkaloids isolated from the roots, stems, and bark of *Cephalotaxus harringtonia*: harringtonine (II), isoharringtonine (III), and homoharringtonine (IV). Harringtonine and isoharringtonine have shown significant inhibitory activity against experimental P388 leukemia in mice.



I, R=H
II, R=C₁₀H₁₇O₅
III, R=C₁₀H₁₇O₅ } isomeric
IV, R=C₁₁H₁₉O₅

Alkaloids II, III, and IV all yield cephalotaxine (I), m.p. 136-137° C., when transesterified with sodium methoxide-methanol along with the respective dimethyl esters V, VI, and VII (transesterification with sodium ethoxide-ethanol gives I and the corresponding diethyl esters).



Molecular weights of the alkaloids were determined by high-resolution mass spectrometry. Structures of esters V, VI, and VII are based on a detailed nuclear magnetic resonance study and analysis of their mass spectral fragmentation patterns. At present, it is not apparent which of the two possible carboxyl groups of V, VI, or VII is originally esterified to cephalotaxine in alkaloids II, III, and IV.

2661 • Anomeric Configuration in Carbohydrates

H. B. Sinclair and Ronald T. Sleeter

Tetrahedron Lett. (11): 833-836. March 1970

A new nuclear magnetic resonance procedure is reported for determining the anomeric configuration in carbohydrates. When a series of 6-deoxy-pyranoside anomers were compared, the C_5-CH_3 peak for the α -anomer was located always at a higher field than the β -anomer.

2662 • The *trans*-6 Fatty Acids of *Picramnia sellowii* Seed Oil

G. F. Spencer, R. Kleiman, F. R. Earle, and I. A. Wolff

Lipids 5(3): 285-287. March 1970

The C_{18} monoenoic acids in *Picramnia sellowii* Planch. seed oil include both *cis*- and *trans*-6-octadecenoic acids, as well as oleic acid. The hexadecenoic acids are also the *cis*- and *trans*- Δ^6 -isomers, and the eicosenoic acids have Δ^6 -unsaturation of undetermined geometric configuration. The C_{18} polyenoic acids detected are 9,12- and 6,9-octadecadienoic and 9,12,15- and 6,9,12-octadecatrienoic acids. Partial investigation of another species, *P. pentandra* Sw., revealed its oil to have a similar fatty acid composition.

2663 • Physiology of Sporeforming Bacteria Associated with Insects.
I. Glucose Catabolism in Vegetative Cells

L. A. Bulla, G. St. Julian, R. A. Rhodes, and C. W. Hesseltine

Can. J. Microbiol. 16(4): 243-248. April 1970

The catabolic pathways for use of glucose in proliferating vegetative cells of *Bacillus thuringiensis*, *B. alvei*, *B. lentimorbus*, and *B. popilliae* were studied by radiorespirometry. These organisms dissimilate glucose predominately via the Embden-Meyerhof-Parnas pathway and to a lesser extent by the pentose phosphate pathway. Extent of participation of concurrent pathways varied with each organism. Tentative evidence suggests that *B. popilliae* and *B. lentimorbus*, grown in a yeast extract-glucose medium, lack a fully operational tricarboxylic acid (TCA) cycle. Dilution of this medium slightly enhanced TCA cycle activity in *B. popilliae* but had no effect with *B. lentimorbus*. Radiorespirometric data regarding glutamic acid oxidation also were obtained for each bacterium. All organisms studied except *B. lentimorbus* were capable of oxidizing glutamic acid to carbon dioxide.

2664 • Water Recycle Method for Washing Alkali-Refined Soybean Oil

R. A. Eisenhauer, R. E. Beal, and E. L. Griffin, Jr.
J. Amer. Oil Chem. Soc. 47(4): 137-140. April 1970

Vegetable oil refineries are faced today with cutting down on pollution caused by their waste water. A method was developed for washing alkali-refined soybean oil with treated, recirculated wash water. In this method, wash water passes through a cation exchange resin that removes sodium, and the slightly acid water goes back into the system for continuous re-use. The disposal problem arising from current industrial practice can be largely or entirely avoided by this re-use method. The new method might well be applicable to other oilseed processing. Batch tests were first made by mixing water, alkali-refined soybean oil, and cation exchange resin. The amount of sodium in the soybean oil was reduced from 34 to less than 0.5 p.p.m. In continuous washing tests conducted in a Podbielniak contactor with water treated by a cation exchange resin, the sodium level of a commercially refined oil (not water-washed) was reduced from 34 p.p.m. to less than 1.5 p.p.m. These results are comparable to or better than those obtained by the conventional method of employing fresh water for washing soybean oil.

2665 • Cultural and Harvesting Methods for Kenaf. . .
An Annual Crop Source of Pulp in the Southeast

G. A. White,¹ D. G. Cummins,² E. L. Whiteley,³ W. T. Fike,⁴
J. K. Greig,⁵ J. A. Martin,⁶ G. B. Killinger,⁷ J. J. Higgins,⁸
and T. F. Clark

(¹USDA Crops Res. Div., Beltsville, Md.; ²University of Georgia, Experiment; ³Texas A&M University, College Station; ⁴North Carolina State University, Raleigh; ⁵Kansas State University, Manhattan; ⁶Clemson University, Clemson, S.C.; ⁷University of Florida, Gainesville; ⁸USDA Crops Res. Div., Glenn Dale, Md.)

USDA Agr. Res. Serv., Prod. Res. Rep. No. 113, 38 pp.
April 1970

Kenaf is a promising new U.S. crop source of raw material for pulp. It is a fast-growing, productive plant with fairly wide adaptation. Excellent, high-yielding pulps are easily obtained. Kenaf generally appears to be competitive for acreage with corn and soybeans, and in some agricultural areas with cotton. Preferred systems of harvesting, handling, and storing kenaf remain to be worked out. Utilization studies on composition, fiber dimensions, pulping processes, and kenaf-wood blends have been conducted. Kenaf should prove to be a versatile raw material for various pulping applications.

2666* • Composition of Sorghum Plant and Grain

Joseph S. Wall and Charles W. Blessin

In "Sorghum Production and Utilization," eds. Joseph S. Wall and William M. Ross, chap. 4, pp. 118-166. Westport, Conn. 1970

As cultivation of sorghum became widespread, different varieties were selected for specialized uses. Sweet sorghums were bred for the sugar contained in their stems and for succulence for use as forages. Among varieties, the grain may differ in amount, color, size, and chemical composition. During plant development, changes in composition occur that are important in selecting the times of cropping for forage or other uses. When compared to other grain or forage crops, sorghums contain distinctive components that offer advantages or may require special consideration during utilization. Therefore an evaluation of a range of compositions related to varieties and hybrids, conditions of cultivation, and time of cropping is essential to select materials for optimum specific uses as food, feed, or fiber. This chapter discusses some factors which influence the composition of plants and grains of various types of sorghums and describes some characteristics of their constituent carbohydrates, proteins, lipids, pigments, minerals, enzymes, and other substances.

2667* • Economic Considerations

Clarence A. Moore¹ and Kenneth R. Majors²

(¹USDA Econ. Res. Serv., Peoria, Ill.; ²USDA Fed. Ext. Serv., Peoria, Ill.)

In "Sorghum Production and Utilization," eds. Joseph S. Wall and William M. Ross, chap. 18, pp. 627-664. Westport, Conn. 1970

As a food, sorghum grain long has been the staff of life to millions in less developed areas of Asia and Africa. As a feed it more recently is serving in the production of meat, milk, and eggs for the more affluent in world society. It is grown in many lands that have dissimilar soils and climates, and is used in diverse ways by different nationalities.

In the U.S., sorghum grain has become in a relatively short time a major aspect of the economy of the Southwest Plains region. Its production now is a large-scale operation, the bulk of the crop moves to market, and it is a major item of agricultural commerce. As such, it encounters problems of marketing, transport, and competition with other commodities.

This chapter mainly discusses economics of producing, utilizing, and marketing domestic sorghum grain. The importance of U.S. sorghum exports justifies a section on U.S. customers and competitors abroad. Since the economics of the grain in this country are affected by conditions elsewhere in the world, world production and use are briefly treated.

2668* • The Future of Grain Sorghum

Clarence A. Moore¹ and D. G. Nelson²(¹USDA Econ. Res. Serv., Peoria, Ill.; ²Grain Sorghum Producers Association, Amarillo, Tex.)

In "Sorghum Production and Utilization," eds. Joseph S. Wall and William M. Ross, chap. 19, pp. 665-686. Westport, Conn. 1970

This chapter focuses on political, social, and economic decisions that condition the environment within which the more proximate, direct forces and their trends that affect the production, processing, marketing, and consumption of sorghum operate. Topics discussed are research and education, U.S. public policy and administrative decisions, foreign trends and policies, and producer organizations.

2669* • Water Vapor Sorption in Starch Granules

William D. Cramer,¹ Thor P. Hanson,¹ George T. Tsao,¹ and Earl B. Lancaster(¹Iowa State University, Ames)

J. Macromol. Sci.-Phys. B3(4): 611-622. December 1969

A mathematical model proposed for diffusion in spherical particles can be solved on a digital computer. The model includes particle size distribution and variable diffusion coefficient of the form $D = D_0 e^{\alpha C}$, where D is the diffusion coefficient, D_0 and α are constants, and C is the moisture content. Isothermal experimental measurements were made gravimetrically on a Cahn electrobalance by vacuum sorption techniques. The model adequately predicts the absorption characteristics of water vapor in starch granules. Although swelling is neglected in the model, it does contribute to sorption characteristics.

2670* • Thermal Conductivity of Starch Granules

Douglas D. Roth,¹ George T. Tsao,¹ and Earl B. Lancaster
(¹Iowa State University, Ames)

Staerke 22(2): 40-44. February 1970

Data were obtained at 25° C. on thermal conductivities of slurries of starch in a carbon tetrachloride-ethyl benzene mixture having a density equal to that of the starch. The thermal conductivity of granular ordinary corn starch was estimated to be 0.125 B.t.u. (foot)/(hour)(foot²)(°F.) by calculation and by extrapolation from the slurry data. The thermal conductivities of granular corn starches decreased with increasing amylose content.

2671* • Thermal Properties of Wheat Flour

T. D. Wheelock¹ and E. B. Lancaster(¹Iowa State University, Ames)

Staerke 22(2): 44-48. February 1970

Data from several sources were pooled to develop a regression equation for predicting the heat capacity of either flour or unmilled wheat at specified temperatures and moisture contents. Similarly, relationships were developed for predicting the heat of hydration of flour at specified moisture contents. Finally, this information was used to prepare a table of enthalpy values for flour.

2672 • Scanning Electron Microscopy of Fungal and Bacterial Spores

J. J. Ellis, L. A. Bulla, G. St. Julian, and C. W. Hesseltine

Proc. Third Annu. Scanning Electron Microscope Symp., IIT

Research Institute, Chicago, Ill., April 28-30, 1970,

pp. 145-152. 1970

The three-dimensional images of fungal spores produced by scanning electron microscopy reveal distinct differences in surface configuration of closely related species. Sporangiospores of 27 heterothallic species and varieties of *Rhizopus* were examined and divided into four groups according to their morphology: (1) globose with distinct protrusions, (2) globose and irregular without sharply defined protrusions, (3) ovoid with slightly elevated ridges parallel to the long axis, and (4) ovoid with highly elevated cylindrical ridges lying at different angles to the long axis. Spores of both *Aspergillus parasiticus* and *Aspergillus flavus* are roughened by clearly defined protrusions extending from the surface. Spores of *A. parasiticus* possess large, blunt peaks, whereas those of *A. flavus* have smaller, rounded peaks accompanied by short ridges. *Aspergillus oryzae* spores have a relatively smooth surface.

Scanning electron micrographs of bacterial spores of *Bacillus lenti-morbus*, *B. popilliae*, *B. cereus*, *B. thuringiensis*, and *B. alvei* revealed various patterns of surface ridges. These ridges range from pronounced and continuous to slight and interspersed. Conversely, spores of *Bacillus licheniformis* and *B. subtilis* are relatively smooth. Scanning electron micrographs of outgrowing cells of *B. thuringiensis* and *B. alvei* are also shown.

- 2673 • Genetic Variation in Cereal Grains and Processing Effects on Cereal Flours as Evaluated by Scanning Electron Microscopy
D. D. Christianson
Proc. Third Annu. Scanning Electron Microscope Symp., IIT
Research Institute, Chicago, Ill., April 28-30, 1970,
pp. 161-168. 1970

Scanning electron microscopy (SEM) is a valuable tool for exploring genetic changes in grain structure. Subcellular structures in high-lysine corn mutants are uniquely different from dent corn now in commercial markets. The varied size and shape of isolated particulates from *opaque-2* and *floury-2* mutants distinguish them from normal corn particulates. Size and shape differences in particulates and their association with amorphous structural protein influence the way in which particles consisting of protein and starch are organized in corn dry-milled products. The association of protein with starch in both wheat and sorghum flours also differs significantly from that of corn.

Processing of cereal grains disrupts the organization and affects the surface structure of protein-starch agglomerates. Changes in protein-starch associations can be observed by SEM when flours are equilibrated with isotonic buffer or water by either steeping, as in wet milling, or conditioning, as in the tempering step in dry milling. Both processing methods partially disrupt agglomerates in flours into free starch granules and protein fragments. The smoothness of the starch granule surface, along with changes in particle size, serves as a criteria for modifying processing techniques so that a maximum disruption of protein surrounding starch granules is achieved. Protein concentrates could be prepared from these processed cereal flours by sieving or air classifying.

- 2674 • A Lipoglycoprotein from Hemolymph of Healthy and Diseased Larvae of the Japanese Beetle, *Popillia japonica*
Glenn A. Bennett and Odette L. Shotwell
J. Invertebr. Pathol. 15(2): 157-164. March 1970

The major protein in the hemolymph of third-instar *Popillia japonica* larvae is a lipoglycoprotein (LGP). This protein was isolated from healthy larvae and larvae infected with *Bacillus popilliae*, a cause of milky disease. The LGP was separated by density gradient centrifugation and partially purified by exhaustive dialysis. During the course of milky disease, the concentration of LGP decreases markedly. Lipids associated with the LGP were extracted and characterized by thin-layer chromatography and gas-liquid chromatography.

Fatty acids detected in significant amounts were palmitic (C_{16}), stearic (C_{18}), oleic ($C_{18:1}$), linoleic ($C_{18:2}$), and lignoceric (C_{24}). The relative concentration of palmitic acid was significantly reduced in LGP isolated from diseased larval hemolymph. Carbohydrate constituents released from LGP by hydrolysis were determined by gas-liquid chromatography of the trimethylsilylated derivatives. Mannose, glucose, and a trace of galactose were present in LGP from hemolymph of normal larvae; however, only trace quantities of any of these carbohydrates could be detected in the LGP from hemolymph of infected larvae. Amino acids present in the greatest amounts in the LGP were aspartic and glutamic acids. Appreciable quantities of tyrosine, leucine, and threonine were also present. The amino acid composition of LGP in hemolymph from healthy larvae did not differ significantly from that in diseased larvae.

2675 • Growth Pattern of *Bacillus popilliae* in Japanese Beetle Larve

Grant St. Julian, Eugene Sharpe, and R. A. Rhodes
J. Invertebr. Pathol. 15(2): 240-246. March 1970

Induction of milky disease in 50% of Japanese beetle (*Popillia japonica*) larvae by feeding requires about 10^9 spores of *Bacillus popilliae* per gram of soil. The infectious process occurs in four phases: (1) An initial incubation phase of about 2 days during which there is no evidence of infection in the hemolymph. (2) A vegetative phase of proliferation in the hemolymph which lasts until day 5 when prespores occur and a few spores first are observed. (3) An intermediate phase between day 5 and day 10 characterized by concomitant vegetative growth, prespore formation, and sporulation; maximum vegetative populations of about 10^9 cells per milliliter hemolymph occur during this phase but the number of spores exceed that of vegetative cells by the end of the phase. (4) Thereafter, a sporulation phase which terminates by day 14 to day 21 with typical milkiness and death of larvae; vegetative populations steadily decline and large numbers of spores accumulate during this phase. Milky larvae contain an average of 5×10^{10} spores per milliliter hemolymph. Throughout the process microscopic evidence indicates many vegetative cells die without forming spores; dead cells disappear from the hemolymph by some unknown lytic or phagocytic process. Thus the massive spore populations which characterize milky disease result from accumulation of spores during a prolonged period of simultaneous vegetative growth and sporulation rather than from an extended period of exclusively vegetative growth followed by sporulation of most cells.

- 2676 • Publications and Patents from Research on New Crops by
Utilization Research and Development Divisions, 1967-1968
North. Util. Res. Develop. Div.
U.S. Agr. Res. Serv., CA-71-30-3, 14 pp. March 1970
[Processed]
- 2677 • Taxonomic Studies of the Aflatoxin-Producing Strains in
the *Aspergillus flavus* Group
C. W. Hesseltine, W. G. Sorenson, and Mabel Smith
Mycologia 62(1): 123-132. January-February 1970

Twenty-eight representative strains of the *Aspergillus flavus* group including *A. flavus*, *A. flavus* var. *columnaris*, *A. parasiticus*, *A. oryzae*, *A. tamarii*, and a new taxon were examined for their ability to utilize a variety of carbon sources. The objective was to find some method which would separate these taxa on other than morphological grounds. Of the 36 compounds tested practically all supported growth of the *A. flavus* group except cellulose and dextran. Utilization of carbon sources does not offer much promise in separating species and varieties but does emphasize the close relationship of all the members of the group. One strain of *A. flavus* var. *columnaris* appears to have a vitamin deficiency. Most of the *A. flavus* strains produced kojic acid. When strains of the *A. flavus* group were grown at various temperatures, all grew at 37° C. and only one grew very poorly at 45° C. The number of sclerotia could be altered drastically by changing the amounts of nitrate and sucrose with the optimal amounts appearing to be about 3% sucrose and 0.5% NaNO₃. All strains tested for their ability to digest gelatine were positive, and all formed amylase. Twelve selected strains were examined for their ability to produce aflatoxin on rice and wheat with constant agitation. No aflatoxin was formed by two *A. oryzae* and two *A. flavus* var. *columnaris* strains. One strain of *A. parasiticus*, which had been in continuous pure culture for 46 years, produced as much as 378 µg./g. of total aflatoxin on wheat.

- 2678 • Variability in the Yeast *Hansenula holstii*
A. I. Herman
Amer. J. Bot. 57(3): 304-308. March 1970

In the heterothallic yeast *Hansenula holstii* morphological variants consisting of a mother cell, stalk, and terminal cell are formed during vegetative growth. Tetrad distribution ratios of clones derived from mother and terminal cells differ. Preceding stalk formation endospore-like structures form in many cells. A causal relationship may exist between formation of the modified nuclei and change in the segregational patterns in the variants.

2679 • Characteristics of a New Strain of *Bacillus popilliae*
Sporogenic In Vitro

E. S. Sharpe, Grant St. Julian, and Clarence Crowell
Appl. Microbiol. 19(4): 681-688. April 1970

Conditions are described that led to the isolation of NRRL B-2309M, a strain of *Bacillus popilliae* which sporulates regularly in laboratory culture. Colonies grown on a medium, formulated with yeast extract and the ingredients of Mueller-Hinton with phosphate, trehalose, and agar, produced 20% spores in 10 to 12 days. The quantity and kind of yeast extract determine the extent of sporulation, although there are other requirements for optimal growth and sporulation. Spore inocula free of viable vegetative cells are necessary to maintain sporogenicity since asporogenic substrains arise spontaneously on solid and in liquid media. One such substrain, NRRL B-2309N, is also asporogenic in larvae, but lethal, owing to vigorous vegetative growth. Strain B-2309M is infective when vegetative cells or spores are injected into Japanese beetle larvae, but fewer spores are formed in vivo than when infections are caused by NRRL B-2309. The characteristics of four related strains of *B. popilliae* are tabulated.

2680 • Yeast Phosphohexosans

M. E. Slodki and J. A. Boundy
Develop. Ind. Microbiol. 11: 86-91. 1970

The occurrence of phosphorylated mannans in yeast cell walls is being studied in a number of laboratories. We reinvestigated the various extracellular phosphomannans elaborated by species of the genus *Hansenula* and related genera. Under a given set of growth conditions, all strains belonging to a particular species produce phosphomannans of similar structure and phosphate content. Two basic types have been found. Phosphomannans with molar ratios of mannose/P < 6 are largely polyphosphodiester of mannose oligosaccharides; about 10% of the polymer consists of a high molecular-weight "core." Phosphomannans with molar ratios of mannose/P > 6 resemble structurally the phosphogalactans produced by *Sporobolomyces*. All the phosphate occurs peripherally as glycosyl-1-phospho-6-mannan. Depending on the species of yeast, the glycosyl end groups may be either glucose, mannose, or mixed hexose and disaccharide.

2681 • Soybean Trypsin Inhibitor: A Reference Protein for Gel Electrophoretic Studies of Soybean Proteins

A. C. Eldridge, J. E. Kalbrener, and W. J. Wolf
Cereal Chem. 47(2): 167-172. March 1970

Earlier studies showed that commercial samples of crystalline soybean trypsin inhibitor (SBTI) were heterogeneous. An automated diethylaminoethyl (DEAE) cellulose chromatographic system was used to purify several commercial samples of SBTI. The SBTI's purified by column chromatography were analyzed by seven different gel electrophoretic procedures. The protein migrated as a characteristic, fast-moving band in most gel systems studied. SBTI can be used as a reference protein to calculate the relative mobilities of other protein bands in electrophoretic studies of soybean proteins.

2682 • Oxirane Ring-Opening Reactions of 3-O-(2,3-Epoxypropyl)-1,2:5,6-di-O-isopropylidene- α -D-glucofuranose

R. E. Wing, W. M. Doane, and C. E. Rist
Carbohydr. Res. 12(3): 347-353. March 1970

Reactions are reported of the oxirane ring of 3-O-(2,3-epoxypropyl)-1,2:5,6-di-O-isopropylidene- α -D-glucofuranose with water, primary and secondary alcohols, lithium aluminum hydride, ammonia, primary and secondary amines, and dipotassium hydrogen phosphate. In most reactions, the expected products were obtained in quantitative yields.

2683 • Structure and Reactions of a Cyanogenetic Lipid from *Cordia verbenacea* DC. Seed Oil

D. S. Seigler, K. L. Mikolajczak, C. R. Smith, Jr., and I. A. Wolff
Chem. Phys. Lipids 4(2): 147-161. April 1970

Cordia verbenacea DC. (Boraginaceae) seed oil consists of a mixture of cyanogenetic, nonglycerol diesters (35%) and ordinary triglycerides. The nitrogen-containing esters are composed of two ordinary fatty acid moieties (predominantly C₂₀) esterified with a five-carbon dihydroxynitrile containing a terminal methylene grouping. All attempts to isolate this diol in an unesterified form resulted in mixtures of unstable products. The diesters form hydrogen cyanide on treatment with base and also yield formaldehyde upon mild alkaline oxidation. Hydrogen uptake is erratic, and varying degrees of hydrogenolysis with formation of monoesters occur when platinum or palladium is used as catalyst. Hydrolysis of the diesters with barium hydroxide gives a mixture of products which appear to be unsaturated hydroxy lactams. γ -Lactones with one acyl group attached are generated by refluxing the diesters with glacial acetic acid containing sulfuric acid as a catalyst.

- 2684 • Gelatinization of Corn and Sorghum Grits by Steam-Cooking
A. J. Peplinski and V. F. Pfeifer
Cereal Sci. Today 15(5): 144, 149-151. May 1970

Direct steam-cooking alters the water-absorption and cooked viscosity properties of corn and sorghum grits. Final cooked paste viscosities of 9% solids suspensions ranged from 1,000 to 40 Brabender units as steam-cooking temperature varied from only 212° F. to 266° F., respectively. Water-absorption index varied from 2.4 after steam-cooking at 212° F. to 5.1 at 266° F. Under identical steaming conditions, corn grits generally yielded higher water-absorption indices and lower cooked paste viscosities than sorghum grits. Proper choice of operating conditions (moisture, temper, and time) gives final processed materials from corn and sorghum grits having a wide range of viscosity and water-absorption properties.

- 2685 • Publications and Patents of the Northern Utilization Research and Development Division, July-December 1969
North. Util. Res. Develop. Div.
U.S. Agr. Res. Serv., Unnumb. Pub., 50 pp. [January 1970]

- 2686 • Copolymers of Starch and Polyacrylonitrile. Influence of Granule Swelling on Copolymer Composition under Various Reaction Conditions
George F. Fanta, Robert C. Burr, C. R. Russell, and C. E. Rist
J. Macromol. Sci.-Chem., A4(2): 331-339. March 1970

Molecular weights and grafting frequencies of graft copolymers prepared with ferrous ammonium sulfate-hydrogen peroxide initiation showed a dependence on granule swelling similar to that found with ceric ammonium nitrate (increased swelling of starch granules decreased the number of grafted polyacrylonitrile chains and increased their average molecular weight). As with unswollen starch, the composition of the copolymer prepared from swollen starch was not influenced by granule size. Molecular weights of polyacrylonitrile branches grafted to swollen and unswollen starch were independent of reaction time; however, grafting frequencies with swollen and unswollen starch tended to converge toward a common value with increased reaction time and increased dilution. Data suggest that the influence of granule swelling on copolymer composition is due to a faster termination rate for growing polyacrylonitrile chains in unswollen starch.

- 2687 • 2,3-Dihydro-3,5-dihydroxy-6-methyl-4*H*-pyran-4-one,
A Novel Nonenzymatic Browning Product
F. D. Mills, D. Weisleder, and J. E. Hodge
Tetrahedron Lett. (15): 1243-1246. March 1970

Thermal degradation of 1-deoxy-1-(1-prolino)-D-fructose at 138°/1 mm. yields 2,3-dihydro-3,5-dihydroxy-6-methyl-4*H*-pyran-4-one (I) as the major solid, volatile product. The structural assignment was made from mass spectral, infrared, and nuclear magnetic resonance analyses of I and its diacetate. Structure I was accepted after the diacetate was prepared from a pyrone derivative; maltol was acetylated, the acetate reduced with Pd/c, and the resulting dihydro derivative was acetoxylated. The synthesized diacetate was identical (MS, NMR, IR) to our acetylated product.

This assignment is significant because it identifies an abundant volatile product formed from a Maillard intermediate and establishes, for the first time, the presence of a dihydropyrone among Maillard reaction products. It also replaces structural proposals for a compound that has been isolated from acidic and basic degradations of D-glucose, the reaction of D-glucose with methylamine and acetic acid, and from the non-enzymatic browning products of dehydrated orange juice.

- 2688 • 9-Aminononanamide and Nylon-9 from Azelaaldehydic
Derivatives of Soybean Oil
W. L. Kohlhasse, E. H. Pryde, and J. C. Cowan
J. Amer. Oil Chem. Soc. 47(5): 183-188. May 1970

9-Aminononanamide, a potential intermediate for nylon-9, was prepared from soybean oil via alkyl soyate, aldehyde oil, or soybean amides. All three routes involved various sequences for reductive ozonolysis, reductive amination, and ammonolysis. The preferred route is through the alkyl soyates, although the other two have fewer steps. The amino amide is a water-soluble, strongly basic solid that rapidly absorbs atmospheric carbon dioxide and is readily hydrolyzed to 9-aminononanoic acid. Although the amino amide is selfpolymerizable to a limited degree, the preferred monomer for nylon-9 is the amino acid. Other new compounds prepared and characterized include azelaaldehydamide, bis(8-carbamoyloctyl)amine; N-(8-carbamoyloctyl)-8-methoxycarbonyloctylamine; 9-hydroxynonanamide; and dimers of the amino amide and the amino ester.

- 2689 • Yeast Taxonomy in Relation to Ecology, Genetics,
and Phylogeny
L. J. Wickerham
Antonie van Leeuwenhoek, Yeast Symp. 1969, Suppl.,
Part I, 35: 31-58. 1969

Many diverse habitats yield new species of yeasts. The discovery of heterothallic and homothallic species of basidiomycetous yeasts is believed to be of prime importance since imperfect yeasts are commonly encountered in various habitats. Some are animal pathogens; others appear related to a group of outstanding plant pathogens, the smuts.

Phylogenetic diagrams that are based on taxonomic data are more meaningful for people who will use them most, and their accuracy can be augmented by additional data from the literature. Polysaccharides produced in cell walls or extracellularly, DNA base ratios, and serology all provide information leading to the clarification of relationships among yeasts, and important contributions in other areas may soon appear on the research scene. Sexually, biochemically, ecologically, and genetically the time seems ripe for rapid advancement of phylogeny in all groups of yeasts. A commensurate advance may be expected in taxonomy based on natural relationships.

- 2690 • Publications and Patents on Fermentation Research
During 1969
North. Util. Res. Develop. Div.
U.S. Agr. Res. Serv., ARS-71-38-2, 8 pp. June 1970
[Processed]
- 2691 • Gas-Liquid Chromatographic Determination of Rotenone
and Deguelin in Extracts of *Tephrosia vogelii*
Diana G. Carlson and W. H. Tallent
J. Chromatogr. Sci. 8(5): 276-278. May 1970

Treatment of rotenone with sodium borohydride gives a derivative that produces a sharp elution peak under gas-liquid chromatographic (GLC) conditions that lead to broad multiple peaks from rotenone itself. The reaction can be carried out rapidly on a small scale and the product injected directly onto the column after a simple workup. When used with a mixture of rotenone and deguelin, such a reduction-GLC sequence provides two distinct peaks. Applicability of the procedure to determine these compounds in crude *Tephrosia vogelii* extracts is demonstrated. Also reported are qualitative results for other rotenoids.

- 2692 • Decomposition of Linoleate Hydroperoxides:
Precursors of Oxidative Dimers
T. L. Mounts, D. J. McWeeny, C. D. Evans, and H. J. Dutton
Chem. Phys. Lipids 4(2): 197-202. April 1970

When hydroperoxides are thermally decomposed in the presence of unsaturated fatty acids, dimers are formed in amounts equivalent to the hydroperoxide present. The origin of these dimers has not been shown by any definitive experiment. Radioactively (^{14}C) labeled materials now have been used to determine whether (1) two molecules of hydroperoxide react, (2) a hydroperoxide and an unoxidized fatty acid molecule form the dimer, or (3) two molecules of unoxidized fatty acid dimerize with hydroperoxide catalysis. Methyl linoleate hydroperoxide and unoxidized methyl linoleate were reacted in experiments, first with the ^{14}C -labeled hydroperoxide and then with ^{14}C -labeled ester. The radiotracer experiments indicate that the dimer is formed from a molecule of the hydroperoxide and a molecule of the fatty ester.

- 2693 • Acetylation of High-Amylose Corn Starch. Influence
of Pretreatment Techniques on Reaction Rate and
Triacetate Solubility
A. M. Mark and C. L. Mehltretter
Staerke 22(4): 108-110. April 1970

Various pretreatment methods for starch were applied to a commercial high-amylose corn starch at apparent 71% amylose content before acetylation in acetic anhydride-pyridine at 100° C. Pretreatments that involved major granule disintegration, such as solubilization of the starch in dimethylsulfoxide or agitation in hot water followed by precipitation of the starches with ethanol and drying, were most effective for obtaining rapid and complete acetylation without degradation. The resulting triacetates, in contrast to the others, were completely soluble in chlorinated hydrocarbon solvents and therefore would be preferred for film and fiber preparation.

- 2694 • Gelatinization of Corn Grits by Roll Cooking,
Extrusion Cooking and Steaming
R. A. Anderson, H. F. Conway, and A. J. Peplinski
Staerke 22(4): 130-135. April 1970

A large variety of cooked corn products can be prepared on rolls, in extruders, or by steaming. Slight changes in operating conditions of equipment can bring about significant changes in absorption, solubility, and viscosity properties of the cooked products. Production of processed materials with high water absorption and retaining high cooked paste viscosity appears more difficult by direct steaming than by use of the other two methods.

Roll cooking should be better than extrusion cooking for preparing materials of maximum water absorption and minimum water solubility. Such materials are well suited either for thick gruels or for industrial thickening or gelling agents. Extrusion cooking should be better for preparing materials of minimum water absorption and maximum water solubility. Such materials are well suited either for beverages or for industrial uses where adhesive properties are desired. Steam cooking should be suitable for preconditioning before roll or extrusion cooking, but it appears that heating time must be held to a minimum.

- 2695 • Distribution of Rotenone and Deguelin in *Tephrosia vogelii*
and Separation of Rotenoid-Rich Fractions
Norman E. Delfel, William H. Tallent, Diana G. Carlson,
and Ivan A. Wolff
J. Agr. Food Chem. 18(3): 385-390. May-June 1970

Rotenone and deguelin were determined by thin-layer densitometry in seven varieties of *Tephrosia vogelii*. The leaflets contained more deguelin than rotenone; the reverse was generally found in the petioles, stems, and roots. One variety contained deguelin but no rotenone. In other varieties the leaflets had more rotenone than other parts of the plant, and several times as much deguelin. Fractionation to recover rotenoid-rich leaflets was possible because they were more friable than stem portions of partially dried plants. Minimizing drying reduced rotenoid destruction. Separation by a whizzer-type air classifier was preferred over hammer or disc mills followed by sieving for three reasons: it was operable with higher moisture material (leaflet moisture content 12 to 14%), so rotenoid loss during drying was reduced; it avoided additional losses possibly caused by frictional heating in the mills; and it gave virtually complete (up to 97%) separation of leaflets from stem-petiole fractions.

- 2696 • Parasiticol: A New Metabolite from *Aspergillus parasiticus*
Robert D. Stubblefield, Odette L. Shotwell, Gail M. Shannon,
David Weisleder, and William K. Rohwedder
J. Agr. Food Chem. 18(3): 391-393. May-June 1970

Parasiticol, a metabolite structurally related to the aflatoxins, has been isolated and characterized. The compound is elaborated by several strains of the *Aspergillus flavus* series previously shown to be aflatoxin producers. The metabolite was separated and purified by chromatography on three columns (silicic acid, silica gel, and alumina) followed by recrystallization from chloroform-hexane. Parasiticol is differentiated from aflatoxins B₁, B₂, G₁, G₂, M₁, M₂, B_{2a}, G_{2a}, and aspertoxin by thin-layer chromatography. Ultraviolet and infrared absorption spectra, nuclear magnetic resonance, and mass spectrometry studies were used to elucidate the structure. Parasiticol is as acutely toxic to ducklings as aflatoxin B₁, but it is only one-hundredth as toxic as B₁ in chick embryo studies.

- 2697 • Glycol Glycosides in Alkyds
W. J. McKillip,¹ J. N. Kellen,¹ C. N. Impola,¹ R. W. Buckney,¹
and F. H. Otey
(¹Ashland Chemical Company, Bloomington, Minn.)
J. Paint Technol. 42(544): 312-319. May 1970

Glycol glycosides derived from starch were successfully prepared in pilot-scale quantities and were demonstrated to have properties and a production cost acceptable for use in both conventional and urethane alkyds. Procedures were developed for incorporating the glycosides into four major classes of alkyds. These alkyds were evaluated in both clear and pigmented films and shown to have superior drying and hardness, equivalent flexibility, but slightly inferior gloss and yellowing characteristics when compared with industrial controls based on pentaerythritol-glycerol polyols.

- 2698* • Current Research on Grain Sorghum
R. A. Anderson, R. W. Jones, and G. E. Inglett
Sorghum Newsletter 13: 21-22. 1970

The continuing research program on grain sorghum at the Northern Division is summarized. Work includes the isolation of sorghum proteins and determination of their properties. Research is also being conducted on the milling and processing of this grain.

2699 • Continuous Fermentation to Produce Xanthan Biopolymer:
Laboratory Investigation

R. W. Silman and P. Rogovin

Biotechnol. Bioeng. 12(1): 75-83. January 1970

Xanthan biopolymer has been produced by single-stage continuous fermentation with *Xanthomonas campestris* NRRL B-1459 in a medium of glucose, minerals, distillers' solubles, and urea for as long as 20 days. At the highest dilution rate studied ($D = 0.0285 \text{ hr.}^{-1}$), the steady state rate of xanthan production was 0.36 g./kg./hr. and the steady state yield, basis glucose consumed, was 68%. Observations indicate that xanthan production rate is a function of pH and D .

2700 • Starch Conversion by Immobilized Glucoamylase

M. J. Bachler, G. W. Strandberg, and K. L. Smiley

Biotechnol. Bioeng. 12(1): 85-92. January 1970

Glucoamylase bound to diethylaminoethyl (DEAE) cellulose in 0.05 M sodium acetate, pH 4.0, is active in the conversion of starch to glucose. The activity of the DEAE-cellulose-bound enzyme ranges from 16 to 55% of the activity of the free enzyme. Binding of the enzyme narrows the pH optimum to approximately 4.0 and lowers the temperature optimum to 40° to 50° C. as compared to a 60° C. temperature optimum for the free enzyme. Concentrations of acetate buffer above 0.1 M disrupt the DEAE-cellulose-enzyme complex. Columns were used with some success for the continuous conversion of starch. Pretreatment of the starch with α -amylase and clarification were necessary to prevent blocking of the column. Columns maintained activity for more than 3 weeks of continuous operation.

2701 • Properties of Wheat Beta-Amylase Adsorbed on Glutenin

John A. Rothfus and Stephen J. Kennel

Cereal Chem. 47(2): 140-146. March 1970

Incubation of saline-soluble wheat beta-amylase with glutenin produces an insoluble enzymatically active complex. The pH profile of the bound enzyme indicates that binding may be selective for only certain wheat amylases. Association with glutenin reduces enzyme activity, but similarity between the kinetic properties of bound and unbound beta-amylase suggests that binding involves a portion of the enzyme that is remote from its catalytic site. Elevated temperatures increase the activity of bound beta-amylase, but the relation between activity and temperature changes at 20° C. Calculated activation energies are 11.7 kcal./mol. between 4° and 20° C. and 8.8 kcal./mol. between 20° and 55° C. The apparent Michaelis constant for the bound enzyme is $0.15\% \text{ (w./v.)}$. Little or no active enzyme is released from the complex by disulfide-reducing agents, 0.1 M NaCl , or temperatures up to 55° C.

- 2702 • Electron Microscopy of Endosperm Protein
from Hard and Soft Wheats
H. L. Seckinger and M. J. Wolf
Cereal Chem. 47(3): 236-243. May 1970

Protein either in flour particles or in thin sections spreads on water as a surface dispersion. These protein dispersions were transferred to plastic-covered specimen grids and examined by transmission electron microscopy. Examinations showed that wheat flour contained lipid which formed small droplets ranging from 0.01 to 0.35 μ in diameter. Protein bodies like those found in immature wheat were not observed in any of the preparations. A purified fraction of gliadin contained particles 20 to 80 Å in diameter, representing molecular weights between 17,000 and 216,000; whereas a glutenin fraction did not form small particles. Protein dispersions from hard and soft wheat had particles 65 to 250 Å in diameter; hard wheat had smaller particles than the soft wheat. Mild treatment with NaHSO_3 increased the size of hard wheat protein particles; those in soft wheat did not change much. From these observations hard wheat appears to have compact protein particles which swell in NaHSO_3 , whereas the structure of soft wheat protein is less dense and they swell in distilled water.

- 2703 • Chlorine Tolerance of Microorganisms Found
in Wheat and Flour
C. P. Kurtzman and C. W. Hesseltine
Cereal Chem. 47(3): 244-246. May 1970

Wheat is frequently washed and tempered in chlorinated water before milling to reduce the microbiological population, but complete destruction of the microorganisms does not occur. Microorganisms commonly found in wheat and flour were tested to determine if they were resistant to the action of chlorine. Molds, yeasts, actinomycetes, and most bacteria were destroyed by low (5- to 25-p.p.m.) levels of chlorine. Only species of *Bacillus* were able to survive chlorine concentrations of 100 p.p.m. or greater. Consequently, survival of microorganisms during the washing and tempering of wheat with chlorinated water generally does not result from the microorganisms having a high tolerance to chlorine.

- 2704 • Chemical Dehulling of Dent Corn
C. W. Blessin, W. L. Deatherage, and G. E. Inglett
Cereal Chem. 47(3): 303-308. May 1970

A process has been developed that rapidly dissolves the pericarp (hull or bran) of dent corn with alkali and leaves the endosperm, aleurone layer, and germ intact. Various times (2, 4, and 6 minutes), temperatures (140°, 160°, and 180° F.), and concentrations (10, 15, and 20% w./w.) were investigated with aqueous solutions of sodium hydroxide to determine its effectiveness as a dehulling agent. Three dent corns (Bear C-14, Bear X-800, and a commercial sample of U.S. No. 2 yellow) were used in this study. In general, a 15% solution of sodium hydroxide at 160° F. essentially dissolved the pericarp in 3 to 4 minutes when agitation was adequate. Residual alkali was neutralized with acetic acid. Average yield of the dehulled corn from this treatment was 93%. Microscopic observation showed that the major portion of the aleurone layer was not removed under these conditions. Alkali dehulling had little measurable effect on ash, ether extract, or protein content. Fiber and total niacin levels were reduced to 50% of their original value.

- 2705 • Films from Mixtures of Viscose and Alkali
High-Amylose Corn Starch
W. B. Roth and C. L. Mehlretter
J. Appl. Polym. Sci. 14(5): 1387-1389. May 1970

Mixtures of viscose and alkali-high-amylose corn starch of apparent 70% amylose content in weight ratios of cellulose to starch of 1.6:1 and 0.5:1 have been coagulated to transparent films having good strength characteristics and fold endurance.

- 2706* • Genetic Diversity Inherent in *Vernonia anthelmintica* (L.) Willd.
C. D. Berry,¹ K. J. Lessman,¹ G. A. White,² and F. R. Earle
(¹Purdue University, Lafayette, Ind.; ²USDA Crops Res. Div.,
Beltsville, Md.)
Crop Sci. 10(2): 178-180. February 1970

Forty selections were used to evaluate inherent genotypic diversity in *Vernonia anthelmintica* (L.) Willd. Materials were evaluated at two locations during 1966 and 1967 for 11 characters.

Analyses of variance indicated significant genotypic variation among lines for all characters except early vigor, days between one-half and full bloom, and percent vernolic acid. Importance of years in a *V. anthelmintica* breeding and evaluation program was emphasized by large year x entry effects.

Genetic coefficient of variation (GCV) values suggested potential for genetic progress. Broad sense heritability estimates (H) indicated differences in efficiency of the design for separating genotypes for characters evaluated. GCV and H estimates were combined in estimates of expected gain from selection in percent of the mean (GS). Values suggested that substantial changes may be made in population means for most characters evaluated.

Phenotypic correlation coefficients indicated simultaneous selection might be practiced for several traits. Selection for good early vigor, early bloom dates, and increased seed number per head also should increase seed and oil yields.

2707 • Separation of *cis*- and *trans*-Aconitic Acids by Thin-Layer Chromatography

J. G. Otten and C. L. Mehltretter

Anal. Biochem. 35(1): 302-303. May 1970

A simple and rapid thin-layer-chromatographic method has been developed for the separation of *cis*- and *trans*-aconitic acids.

2708 • An Internal Standard for Amino Acid Analyses:

S- β -(4-Pyridylethyl)-L-cysteine

James F. Cavins and Mendel Friedman

Anal. Biochem. 35(2): 489-493. June 1970

The new amino acid, *S*- β -(4-pyridylethyl)-L-cysteine (PEC), was prepared by treating L-cysteine with 4-vinylpyridine in an aqueous medium containing triethylamine. The postulated structure for PEC was confirmed by infrared, nuclear magnetic resonance, and mass spectroscopic analyses. PEC is stable to acid under conditions used for protein hydrolysis, it elutes on a basic column as a discrete peak before arginine, and its ninhydrin color is linear with concentration.

The new amino acid has been evaluated as an internal standard for amino acid analyses. Equally excellent results were obtained when PEC was added to the protein either before or after hydrolysis. Addition of PEC before hydrolysis eliminates the need for nitrogen analysis of the hydrolyzate and for accurate sample application to the column.

- 2709 • Retarded Hydrolysis by Pancreatic Lipase of Seed Oils with *trans*-3 Unsaturation
R. Kleiman, F. R. Earle, W. H. Tallent, and I. A. Wolff
Lipids 5(6): 513-518. June 1970

Triglycerides containing acids with *trans*-3 unsaturation (16:1³, 18:1³, and 18:3^{3,9,12}) showed a marked retardation of reaction rate with pancreatic lipase. An inverse relationship was found between content of *trans*-3 unsaturated acids in seed oils and lipolysis rate. The *trans*-3 unsaturated acids were concentrated in the diglyceride and residual triglyceride fractions of the lipolysates, and only small amounts were present in the free acid and monoglyceride fractions.

- 2710* • Proton Magnetic Resonance Spectra of the Mannans of Some New Species of *Hansenula* and Their Phylogenetic Significance
J. F. T. Spencer,¹ P. A. J. Gorin,¹ and L. J. Wickerham
(¹Prairie Regional Laboratory, National Research Council of Canada, Saskatoon, Saskatchewan)
Can. J. Microbiol. 16(6): 445-448. June 1970

The proton magnetic resonance spectra of the mannose-containing polysaccharides from some new species of *Hansenula* were obtained and used as an aid in establishing their phylogenetic relationships to other members of the genus. The spectrum of the mannan from *Hansenula dimennae* is identical with that of the mannan from *Hansenula californica*. These two haploid species are taxonomically closely related and are adjacent on the same line of the phylogenetic diagram according to Wickerham. *Hansenula saturnus* var. *subsufficiens* mannan has a spectrum like those of the mannans of some strains of *Hansenula mrakii* and *Hansenula beijerinckii*. The new species *Hansenula henrici*, *Hansenula nonfermentans*, and *Hansenula glucozyma* all form mannans with spectra having characteristic signals at about τ 4.24 and τ 4.38, as do the spectra of the mannans formed by the other species on the same phylogenetic line, *Hansenula polymorpha*, *Hansenula minuta*, and *Hansenula wickerhamii*. These species have, relatively, DNA's with the highest guanine and cytosine percentages in the genus. *Hansenula platypodis*, a species which, unlike other *Hansenula* species, forms ascophores and anastomoses, has DNA with a lower content of guanine plus cytosine. The spectrum of *H. platypodis* mannan is like that of *H. minuta* mannan, with the exception of two small signals at τ 4.44 and τ 4.48 which do not occur in the spectrum of *H. minuta* mannan.

- 2711* • Hydrogenation with Homogeneous and Heterogeneous Catalysts
E. N. Frankel and H. J. Dutton
In "Topics in Lipid Chemistry," ed. F. D. Gunstone, vol. 1,
pp. 161-276. London. 1970

Current knowledge of hydrogenation chemistry with homogeneous and heterogeneous catalysts is reviewed and assessed. Old and current theories are evaluated and new concepts developed to explain the mechanism of catalytic hydrogen-transfer reactions. Hydrogenation and isomerization by homogeneous and heterogeneous catalysts are related mechanistically. An attempt is made to bridge the gap between homogeneous and heterogeneous catalyses because observations in one field may have direct implications and applications in the other.

- 2712 • Preparation and Counting of Lipophilic Samples
Paul J. Thomas and H. J. Dutton
In "The Current Status of Liquid Scintillation Counting,"
ed. Edwin D. Bransome, Jr., pp. 164-169. New York. 1970

This paper, part of a symposium on liquid scintillation counting, reviews techniques used in the preparation of lipophilic samples. Since lipids are generally purified by chromatographic procedures, the assay of samples collected from chromatographic columns is discussed in detail. We also describe computerized methods for enhancing data presentations by providing graphical comparison of single or double isotope distribution and composition by weight.

- 2713* • Optically Active Long-Chain Compounds and Their Absolute Configurations
C. R. Smith, Jr.
In "Topics in Lipid Chemistry," ed. F. D. Gunstone, vol. 1,
pp. 277-368. London. 1970

Almost all the compounds in this chapter review are of lipid origin. Emphasis is placed on their natural sources and methods for their synthesis, as well as on compounds whose absolute configurations have been established. Examples of configurational correlation by synthesis, as well as by degradation, are given. The use of optical rotatory dispersion in making configurational assignments is stressed.

REPUBLICATION

2413 • Mycotoxins

C. W. Hesseltine

Mycopathol. Mycol. Appl. 39(3-4): 371-383. December 1969

This paper briefly reviews the various mycotoxins currently being investigated, with emphasis on the aflatoxins. Emphasis is placed on the problem of aflatoxins as they affect domestic animals and the environmental conditions influencing the formation of aflatoxin.

The original article appeared in the Proceedings of the Sixth European Feed Manufacturers Congress, held at Brighton, England, September 30-October 4, 1968. Reviews of this paper have been published in Italian ["Le Micotossine Nei Mangimi," Tec. Molitoria 19(18): 506-518. 1968] and in French ["Les Mycotoxines," Econ. Med. Anim. (Paris) 11(2): 75-91. March-April 1970].

UNOFFICIAL PUBLICATIONS

Listing of Publications and Patents of the Northern Utilization Research and Development Division would not be complete without including some unofficial publications. These are writings by members of the Northern Division staff, and, although written from previously published official material, are of a public service value from the standpoint of review and updating of the literature.

Annual Crop Fibers and the Bamboos

T. F. Clark

In "Pulp and Paper Manufacture. Vol. II. Control, Secondary Fiber, Structural Board, Coating," 2nd ed., eds. R. G. Macdonald and J. N. Franklin, pp. 1-74. New York. October 1969

The need and the opportunities to use nonwood plants throughout the world in papermaking and board manufacture are discussed. Availability, procurement and storage, physical and chemical properties, processing, and economics of utilization of these fibers are considered. Behavior of these raw materials under conditions of various processing treatments is described. The importance and utility of sugarcane bagasse, cereal grain straws, esparto, *Arundo donax*, reeds, Manila hemp, and kenaf, as well as many less-familiar fiber sources, are examined. Much experimental data are provided to support the text.

CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research work done by an outside agency under contract with the U.S. Department of Agriculture and supervised by the Northern Utilization Research and Development Division.]

- 219-C • Copolymerization of Ethylene and Unsaturated Fatty Acid and Gum Naval Stores Compounds
C. J. Vetter, Jr.
U.S. Industrial Chemicals Company, Tuscola, Ill.
Aust. Chem. Eng. 9(4): 3-12. April 1968
- 222-C* • DL-4-Acetamido-4-hydroxy-2-butenic Acid γ -Lactone
Joan A. Gratz, C. E. Cook, and Monroe E. Wall
Research Triangle Institute, Research Triangle Park, N.C.
Org. Prep. Proced. 2(1): 51-52. February 1970
- 224-C • Amino Acid Composition and Nutritional Value of Milled Fractions of Sorghum Grain
F. K. Shoup, C. W. Deyoe, L. Skoch, M. Shamsuddin, J. Bathurst, G. D. Miller, L. S. Murphy, and D. B. Parrish
Kansas State University, Manhattan
Cereal Chem. 47(3): 266-273. May 1970
- 225-C • Air-Classification and Baking Characteristics of High-Protein Atlas 66X Comanche Lines of Hard Red Winter Wheat
P. J. Mattern, V. A. Johnson, and J. W. Schmidt
University of Nebraska, Lincoln
Cereal Chem. 47(3): 309-316. May 1970

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Utilization Research and Development Division.]

- 63-G* • Nucleophilic Displacement in 1,2:5,6-Di-*O*-isopropylidene-3-*O*-(*p*-tolylsulfonyl)- α -D-glucofuranose
U. G. Nayak and Roy L. Whistler
Purdue University, Lafayette, Ind.
J. Org. Chem. 34(12): 3819-3822. December 1969
- 64-G* • Photolysis of Methyl 2,3,4-Tri-*O*-acetyl-6-azido-6-deoxy- α -D-glucopyranoside
Roy L. Whistler and A. K. M. Anisuzzaman
Purdue University, Lafayette, Ind.
J. Org. Chem. 34(12): 3823-3824. December 1969
- 65-G • Reaction of Alkyl Vinyl Ethers with D-Galactose Diethyl Dithioacetal
M. L. Wolf from and G. G. Parekh
The Ohio State University, Columbus
Carbohydr. Res. 11(4): 547-557. December 1969
- 69-G* • Anisotropic Scattering by Single Starch Granules
J. Borch, A. Sarko, and R. H. Marchessault
State University of New York, College of Forestry, Syracuse
Staerke 21(11): 279-284. November 1969
- 70-G • Calculation of Degree of Substitution of Polysaccharides: A Fortran Computer Program
D. Horton and W. D. Pardoe
The Ohio State University, Columbus
Carbohydr. Res. 12(2): 269-272. February 1970
- 71-G • Synthesis of the 6-Aldehyde Derivative of Cellulose, and A Mass-Spectrometric Method for Determining Degree of Substitution
D. M. Clode and D. Horton
The Ohio State University, Columbus
Carbohydr. Res. 12(3): 477-479. March 1970
- 72-G* • Multiple Attack and Polarity of Action of Porcine Pancreatic α -Amylase
John F. Robyt and Dexter French
Iowa State University, Ames
Arch. Biochem. Biophys. 138(2): 662-670. June 1970

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the Authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Utilization Research and Development Division.]

- 293-F • Light-Scattering Studies on Aqueous Solutions of Amylose and Amylopectin
W. Banks, C. T. Greenwood, and J. Sloss
University of Edinburgh, Edinburgh, Scotland
Carbohydr. Res. 11(3): 399-406. November 1969

- 294-F • Alcohol-Soluble Proteins of Grain Sorghum
L. V. S. Sastry and T. K. Virupaksha
Indian Institute of Science, Bangalore, India
Cereal Chem. 46(3): 284-293. May 1969

- 295-F • Anionic Graft Polymerization of Ethylene Oxide on Starch. I.
Menashe Tahan and Albert Zilkha
The Hebrew University, Jerusalem, Israel
J. Polym. Sci., Part A-1, 7(7): 1815-1824. July 1969

- 296-F • Rheologische Charakterisierung von Stärkepasten und Streichfarben [Rheological Characterization of Starch-pastes and Coating Formulations. In German. English summary, p. 784]
J. Schurz, K. H. Schmidt, H. Uragg, and J. Renger
University of Graz, Graz, Austria
Fortdrucke 23(10A): 784-794. October 1969

- 297-F • Isolation of Pure Aldobiouronic & Aldotriouronic Acids from Plant Gums & Mucilages
K. S. Bajpai, V. Chandrasekharan, S. Mukherjee, and A. N. Shrivastava
National Sugar Institute, Kanpur, India
Indian J. Chem. 8(1): 48-50. January 1970

- 298-F • Anionic Graft Polymerization of Methacrylonitrile on Potassium Starch Alkoxide
Menashe Tahan and Albert Zilkha
The Hebrew University, Jerusalem, Israel
J. Polym. Sci., Part A-1, 7(7): 1839-1860. July 1969

- 299-F • Anionic Graft Polymerization of Ethylene Oxide on Starch.
II. Structure of the Graft Polymers
Menashe Tahan and Albert Zilkha
The Hebrew University, Jerusalem, Israel
J. Polym. Sci., Part A-1, 7(7): 1825-1837. July 1969
- 300-F • Comments on "Enzymic Methods for the Microdetermination of
Glycogen and Amylopectin, and Their Unit Chain-Lengths"
W. Banks and C. T. Greenwood
University of Edinburgh, Edinburgh, Scotland
Arch. Biochem. Biophys. 136(1): 320-322. January 1970
- 301-F • The Isolation of 1,2-*O*-Ethylene Derivatives of D-Glucose
from *O*-(2-Hydroxyethyl)starch
H. C. Srivastava, K. V. Ramalingam, N. M. Doshi,
and A. S. Chaudhari
Ahmedabad Textile Industry's Research Association,
Ahmedabad, India
Carbohydr. Res. 12(1): 23-28. January 1970
- 302-F • The Characterization of Starch and Its Components. Part 2.
The Semi-Micro Estimation of the Starch-Content of Cereal
Grains and Related Materials
W. Banks, C. T. Greenwood, and D. D. Muir
University of Edinburgh, Edinburgh, Scotland
Staerke 22(4): 105-108. April 1970
- 303-F* • Beitrag zur Mikroskopischen Charakterisierung von Hitze-
modifizierten Stärken [Contribution to Microscopical
Characterization of Heat Treated Starches. In German.
English summary, p. 213]
A. Cimerman, M. Blinc, and D. Stucin
Slovenian Academy of Sciences and Arts, Ljubljana, Yugoslavia
Staerke 21(8): 211-214. August 1969
- 304-F • Microbial Formation of Tartaric Acid from Glucose
Koichi Yamada, Yasuji Minoda, Toru Kodama, and Uichiro Kotera
University of Tokyo, Tokyo, Japan
In "Fermentation Advances," ed. D. Perlman, pp. 541-560.
New York. 1969

- 305-F • Grafting of Preformed Polyethylene Oxide on Starch
Gabriel Ezra and Albert Zilkha
The Hebrew University, Jerusalem, Israel
J. Appl. Polym. Sci. 13: 1493-1496. 1969
- 306-F • Identification of the Carbohydrate-Protein Linking
Group in Soybean Hemagglutinin
Halina Lis, Nathan Sharon, and Ephraim Katchalski
Weizmann Institute of Science, Rehovoth, Israel
Biochim. Biophys. Acta 192(2): 364-366. November 1969
- 307-F • Distribution of Methoxyl Groups in the Methylation of
Starch Alkoxides Obtained by Metallation with Alkali
Metal Naphthalene
Gabriel Ezra and Albert Zilkha
The Hebrew University, Jerusalem, Israel
J. Macromol. Sci.-Chem. A3(8): 1589-1600. December 1969
- 308-F • Über Modifizierte Maisstärke [On Modified Corn Starch.
In German. English summary, p. 73]
M. Blinc, A. Cimerman, E. Pertot, and D. Stucin
Slovenian Academy of Sciences and Arts, Ljubljana, Yugoslavia
Staerke 22(3): 73-76. March 1970

January-June 1970

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PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231. Order by number, do not send stamps.]

Linseed Oil Emulsion Paints

Lambertus H. Princen

U.S. Patent 3,488,202. January 6, 1970

Brilliantly white, very fast drying, mildew resistant, easily redispersible linseed oil-in-water emulsion exterior paints, dry coatings of which show no damage from 24 hours of water immersion, are obtained by sharply decreasing the prior art 5 to 12% combined concentration of nonionic emulsifiers and anionic dispersants to a level of 0.31 to 1.14% nonionic and in partial replacement therefor, adding a highly synergistic 0.575 to 1.46% (exclusive of the vehicle and based on the entire formulation) of one or a mixture of cationic higher alkyl quaternary ammonium chloride emulsifiers.

Process for Isolating Vinyl-Type Component of Starch Graft Copolymers

Lewis A. Gugliemelli and M. Ollidene Weaver

U.S. Patent 3,491,040. January 20, 1970

The polyvinyl component of starch graft copolymers is isolated by a novel method involving periodate oxidation of the starch to the dialdehyde moiety, which is then catalytically depolymerized at room temperature with sodium methoxide in anhydrous methanol. The liberated undepolymerized vinyl component can be readily, and essentially quantitatively, isolated for weighing and other analytical procedures.

Azo Dyes of Starch Anthranilates and Process of Preparing Same

Charles L. Mehlretter

U.S. Patent 3,499,886. March 10, 1970

Starch-based azo dyes are obtained by diazotizing starch anthranilate esters and coupling the diazotized intermediate with a conventional aromatic coupling agent. Dispersions of the predominantly red high molecular weight dyes also contribute significant viscosity effects.

Ozonization of Vegetable Oils in an Improved Aqueous Medium

Robert E. Beal

U.S. Patent 3,504,038. March 31, 1970

Formation of a tenacious creamlike phase that limits the ozonization of a polyunsaturated vegetable oil in an aqueous medium and wastes costly ozone is prevented by the prior addition of a C₆-C₉ aldehyde or dimethyl acetal thereof and whereby aldehydic products are obtained.

Cyclic C₁₈ and C₂₀ Alcohols

Edward W. Bell and John C. Cowan

U.S. Patent 3,513,205. May 19, 1970

Disubstituted cyclohexane monocarboxylic acids having 18 and 20 carbon atoms are catalytically reduced to the corresponding alcohols. The latter have high molecular weights and low melting points, are not readily subject to oxidative deterioration, and are useful as substitutes for palmityl alcohol and lanolin in cosmetic creams.

Selective Hydrogenation of Soybean Oil with Supported Copper Catalysts

Sambasivarao Koritala

U.S. Patent 3,515,678. June 2, 1970

Extremely active and selective hydrogenation catalysts that permit soybean oil to be sufficiently hydrogenated in about 11 minutes for subsequent winterizing to a stable salad oil comprise copper deposited either on micronized silica having a high content of surface hydroxyl groups or on molecular sieve zeolites having pore sizes of either 4 Å or 10 Å.

Hypochlorite Modified Cyanoethylated Starch Having Intact Granule Form

Charles L. Mehlretter and Carl A. Wilham

U.S. Patent 3,515,718. June 2, 1970

Cyanoethylated starch in intact granule form is oxidized with hypochlorite under mildly alkaline conditions that preserve the intact granule form and prevent internal crosslinks. The product has carboxyl, carbonyl, cyanoethyl, and carboxyethyl functionality and forms stable, high solids aqueous solutions after being pasted in hot water. The solutions are used as paper sizings.

Graft Polymerization of Starch in Novel Alcohol Reaction Medium

Zoila Reyes and Charles R. Russell

U.S. Patent 3,518,176. June 30, 1970

Process for graft polymerizing onto a starch, amylose, or amylopectin, a vinyl monomer in an aqueous medium, the improvement comprising replacing part of the water with an equal volume of ethylene glycol, glycerol, *n*-butanol, sorbitol, or dimethylformamide. The reaction is initiated by radiation or ceric-ion.

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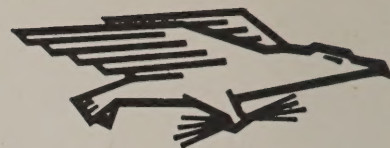
applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Similar lists of publication abstracts and patents are available from the other four Regional Research Divisions of the Agricultural Research Service, U.S. Department of Agriculture. The addresses and fields of research covered are:

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